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Form Approved  
OMB No. 0704-0188

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1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE 6-25-94	3. REPORT TYPE AND DATES COVERED Final 8-7-91-5-6-94	
4. TITLE AND SUBTITLE Siloxane-Based Ferroelectric Liquid Crystal Elastomers and Self-Assembled Mono- and Multilayers			5. FUNDING NUMBERS N00014-91-J-2005	
6. AUTHOR(S) David M. Walba				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of Colorado Chemistry Department Boulder, CO 80309			8. PERFORMING ORGANIZATION REPORT NUMBER 153-4147	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Department of the Navy Naval Research Laboratory 4555 Overlook Ave. S.W. Washington, D.C. 20375-5000			10. SPONSORING/MONITORING AGENCY REPORT NUMBER  DTIC SELECTED DEC 08 1994 F	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT  This document has been approved for public release and sale; its distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) A convenient new method for synthesis of self-assembled monolayers on float glass substrates has been developed. This method allows the synthesis of SAMs composed of ferroelectric liquid crystal mesogens. Using the ferroelectric liquid crystal SAMs or simple alkane SAMs, a unique type of liquid crystal alignment is demonstrated where the surface, which is smooth to a few angstroms by atomic force microscopy, provides a uniform tilt in the direction of rubbing when rubbed SAMs are used as substrates for the liquid crystal sample  DTIC QUALITY INSPECTED 8				
14. SUBJECT TERMS			15. NUMBER OF PAGES 2	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT	

19941129 148

# Siloxane-Based Ferroelectric Liquid Crystal Elastomers and Self-Assembled Mono- and Multilayers

Summary of Accomplishments

David M. Walba  
Department of Chemistry and Biochemistry  
University of Colorado  
Boulder, CO 80309-0215

and

Noel A. Clark  
Department of Physics  
University of Colorado  
Boulder, CO 80309-0390

Accession For	
NTIS CRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification .....	
By .....	
Distribution /	
Availability Codes	
Dist	Avail and/or Special
A-1	

During the project period our work focussed on siloxane-based self-assembled monolayers (SAMs) for liquid crystal alignment. A new method for synthesis of high quality SAMs on float glass was developed. The method is much simpler to use than previous approaches, and most importantly, is ammenable to preparation of SAMs possessing the functionality commonly encountered in ferroelectric liquid crystals (FLCs).

Thus, simple octadecylsiloxane SAMs were prepared by dipping a float glass plate into a toluene solution of octadecyltriethoxysilane in the presence of a catalytic amount of n-butylamine. After 10 min the plate is removed and allowed to stand for 48 hrs. The resulting SAMs were extremely robust, and also of high quality as evidenced by contact angle measurements and atomic force microscopic examination. The approach could also be applied to FLC mesogens possessing triethoxysilyl groupings at a terminal carbon on one of the tails. The FLC-SAMs were more difficult to grow, requiring extended dipping times and heating after removal from the solution. But, they too were of high quality by the standard tests.

The simple alkane SAMs showed unique liquid crystal alignment properties which to our knowledge have never been seen before. Specifically, vigorous uniaxial rubbing of the SAMs gave a very smooth surface which promoted homeotropic nematic alignment, homeotropic alignment in the smectic A phase, and a Schlieren monodomain alignment in the smectic C phase when the two bounding plates were oriented antiparallel. With chiral smectic C\* materials, a Schlieren monodomain was obtained with either parallel or antiparallel-oriented bounding plates. This suggests that the LC director tilts parallel to the rubbing direction in a homeotropic sample.

Photolithographic patterning of the surfaces using deep UV light resulted in parallel alignment where the light hit, and homeotropic alignment where no light hit. Such surfaces, when rubbed, gave excellent Schlieren monodomains in the masked areas, and excellent parallel-aligned domains (director along the rubbing direction) in the irradiated regions. This provides unique and powerful control over LC supermolecular structure not obtainable previously. In addition, shorter irradiation times gave pretilted nematics where the degree of pretilt could be controlled by the irradiation time.

Finally, using irradiation and electroless metal deposition, electrodes were placed across homeotropically aligned FLC-SAMs. Application of electric fields, however, did not switch the surface, as evidenced by the fact that the tilt direction of an overlying smectic phase remained oriented along the original rubbing direction after application of fields. Experiments aimed at demonstrating surface switching are still in progress.